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NINETEENTH ANNUAL REPORT

OF THE

South Carolina Experiment Station

OF THE

CLEMSON AGRICULTURAL COLLEGE

FOR THE YEAR ENDING

JUNE 30, 1906

COLUMBIA, S. C.
THE R. L. BRYAN COMPANY
1906

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CLEMSON AGRICULTURAL COLLEGE

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F. S. Shiver, Ph. G., *Chemistry.*
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B. F. Robertson, B. S., *Chemistry and Fertilizer Control.*
D. H. Henry, B. S., *Chemistry.*
W. E. Dickinson, B. S., *Chemistry Assistant (Fertilizer Control).*
J. H. Mitchell, M. S., *Chemistry Assistant (Fertilizer Control).*
J. M. Burgess, B. S., *Herdsman.*
W. D. Garrison, B. S., *Foreman of Station Farm.*
J. M. Jenkins, B. S., *Foreman Coast Land Experiment Station.*
Miss Helen Bradford, *Stenographer.*

Mail and telegraph: Clemson, S. C.

Freight and express: Calhoun, S. C.

The bulletins of the Station are issued at irregular intervals, and are sent free to all citizens of the State who apply for them.

1907 Rud

CLEMSON COLLEGE, S. C., November 20, 1906.

Hon. D. C. Heyward, Governor of South Carolina.

Sir: I have the honor to submit herewith the nineteenth Annual Report of the South Carolina Agricultural Experiment Station, in accordance with the requirements of an Act of Congress approved March 2, 1887, for the Establishment of Agricultural Experiment Stations in connection with the Colleges of the several States, organized under the provisions of an Act approved July 2, 1862.

Respectfully submitted,

P. H. MELL,
President.

16609

THE SOUTH CAROLINA EXPERIMENT STATION
HATCH FUND,
In Account with
THE UNITED STATES APPROPRIATION, 1905-1906.

DR.

To Receipts from the Treasurer of the United States, as per appropriation for fiscal year ended June 30, 1906, as per Act of Congress, approved March 2, 1887 ..... $15,000 00

CR.	ABSTRACT.	
By Salaries	1	$10,821 38
Labor	2	1,448 56
Publications	3	630 00
Postage and stationery	4	94 54
Freight and express	5	87 56
Heat, light, water and power	6	83 73
Chemical supplies	7	400 22
Seeds, plants and sundry supplies	8	357 03
Fertilizers	9	264 48
Feeding stuffs	10	48 22
Library	11	105 80
Tools, implements, and machinery	12	172 47
Furniture and fixtures	13	11 50
Scientific apparatus	14	
Live stock	15	16 00
Traveling expenses	16	148 92
Contingent expenses	17	56 11
Building and repairs	18	253 48
Balance		
Total		$15,000 00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Treasurer of the Hatch Fund for the fiscal year ended June 30, 1906; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to

have been $15,000.00, and the corresponding disbursements $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

Signed:

R. W. SIMPSON,
Chairman Finance Committee, Auditors.

Attest:

P. H. E. SLOAN,
Custodian.

THE SOUTH CAROLINA EXPERIMENT STATION
ADAMS FUND,

In Account with
THE UNITED STATES APPROPRIATION, 1905-1906.

DR.

To Receipts from the Treasurer of the United States, as per appropriation for fiscal year ended June 30, 1906, as per Act of Congress, approved March 16, 1906.....$..... $5,000 00

CR.	ABSTRACT.	
By Salaries	1	$.....
Labor	2	25 00
Publications	3	.....
Postage and stationery....	4	43 50
Freight and express.....	5	118 75
Heat, light, water and power	6	.....
Chemical supplies	7	10 00
Seeds, plants and sundry supplies	8	28 87
Fertilizers	9	.....
Feeding stuffs	10	154 90
Library	11	.....
Tools, implements, and machinery	12	132 50

Furniture and fixtures	13	.....	
Scientific apparatus	14	498 70	
Live stock	15	2,295 00	
Traveling expenses	16	2 90	
Contingent expenses	17	.....	
Building and repairs	18	250 00	
			3,560 12
Balance			1,439 88
Total			$5,000 00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the Treasurer of the South Carolina Experiment Station for the fiscal year ended June 30, 1906; that we have found the same well kept and classified as above, and that the receipts for the year from the Treasurer of the United States are shown to have been $5,000.00, and the corresponding disbursements $3,560.12, for; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving $1,439.88.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 16, 1906.

Signed:

R. W. SIMPSON,
Chairman Finance Committee, Auditors.

Attest:

P. H. E. SLOAN,
Custodian.

REPORT OF THE DIRECTOR.

CLEMSON COLLEGE, S. C., November 20, 1906.

Dr. P. H. Mell, President Clemson College.

Dear Sir: I have the honor to submit herewith the Annual Report of the South Carolina Agricultural Experiment Station for the fiscal year ending June 30th, 1906:

The work of the station is becoming more efficient, due to increased equipment and to the fact that the college work has

been arranged so that more time could be devoted to research work. Since the station income from the Federal Government will be considerably increased on account of the passage of the Adams Bill, our experimental work can be greatly enlarged and carried out with more thoroughness. To obtain the best results, it will be our policy to undertake only a limited number of experiments, and only those the results of which will be of the greatest practical value to our farmers.

An accurate map has been made of the experiment station grounds, and the results of each plot can be definitely located and recorded. The experimental work of the Agricultural Division pertaining to the production and improvement of plants has been assigned to the supervision of the agriculturist, and those experiments pertaining to soil improvement and the use of commercial fertilizers will be under the supervision of the Director.

The new greenhouse erected on the campus out of the college funds has been completed. This greenhouse is thoroughly modern in every respect, and the station officers are grateful to the college authorities for such a building. This greenhouse will greatly increase the opportunities of the station for work. The Divisions of Horticulture, Entomology, Agronomy, Botany and Soils will conduct experiments in this building.

During the past year, eight of the officers of the experiment station devoted a portion of their time to Farmers' Institute work.

The work of the Coast Land Experiment Station, located at Charleston, continues to pursue a line of experiments with forage plants. Some valuable results have been obtained from these experiments. Enormous yields of hay per acre have been harvested from alfalfa, beggar weed, teosinte, sorghum, cowpeas, Kafir corn, barley, rye, oats, and wheat, when the proper cultivation and fertilizers were applied.

The appended reports summarize fully the details of this year's experiments.

Thanking you most heartily for your kindly interest in this work, and for valuable suggestions you constantly give us, I remain

Yours very respectfully, J. N. HARPER,
Director.

REPORT OF CHEMIST.

CLEMSON COLLEGE, S. C., November 1, 1906.

Prof. J. N. Harper, Director S. C. Experiment Station.

Sir: I respectfully submit the following report of the Chemical Department of the station for the year ending June 30, 1906:

In the small experimental plant, which was erected and equipped with the necessary machinery last year, several hundred pounds of starch were made from sweet potatoes. The work was commenced late in the season and the potatoes were mainly of one variety, but it was thought advisable to make a few runs of starch in order to test the machinery and the character of the product. Under the circumstances the results were encouraging. Samples of the starch were tested at a few cotton mills and laundries, and very favorable reports were received. The pulp left as a by-product, after the extraction of the starch, promises to make a useful cattle food. There was not enough of it for any extended trials in feeding, but the Professor in charge of the Dairy Division of the station was sufficiently interested to express a desire to continue the investigation of its merits this year.

Certain changes in the machinery of the plant are now being made, with the view of increasing the yield of starch. It is also intended to try different varieties of sweet potatoes in order to ascertain the kind best suited for the manufacture. The numerous analyses of the potatoes, starch and pulp were made by Mr. C. C. McDonnell, who has also had charge of the erection and equipment of the experimental plant and of the process of manufacturing the starch.

The work done this year by Mr. F. S. Shiver has been of a co-operative nature. He has analyzed 12 samples of wheat for the Director of the station, making both protein and moisture determinations. He has also co-operated with the Professor of Dairying in studying the conditions which affect the water content of butter. In this investigation he determined water, fat, casein and salt in 55 samples.

In addition to the work mentioned there have been analyzed a sample of marl for the Director of the station, and a sample of cottonseed meals for Mr. V. P. Hudson, of Greenville, S. C. These analyses were made by Mr. D. H. Henry.

ANALYSES OF COMMERCIAL FERTILIZERS.

Following is a report of work on commercial fertilizers, done under the direction of the Fertilizer Control Committee of the Board of Trustees:

	Season 1904-5.	Season 1905-6.
Official samples	522	655
Farmers' samples	19	48
Special official samples of cottonseed meal	84	—
	625	703

OFFICIAL SAMPLES OF FERTILIZERS.

The number of samples analyzed this year is 655.
The analyses are given in full in Bulletin No. 119.

Classification.

	1905.	1906.
Complete fertilizers	250	325
Acid phosphates	81	87
Acid phosphates with potash	82	94
Cottonseed meal	62	79
Kainit	26	29
Nitrate of soda	7	19
Muriate of potash	6	13
Sulphate of potash	0	2
Nitrate of soda with potash	1	2
Ground fish	3	0
Tankage	0	2
Dried blood	1	1
Miscellaneous	3	2
Total	522	655

Deficient Samples.

Of the 655 samples analyzed in 1906, thirty were deficient under the law. In addition to these, there were 201 samples which fell below the guarantee in one or more constituents, as follows:

In available phosphoric acid	22
In available phosphoric acid and ammonia	1
In available phosphoric acid and potash	2
In available phosphoric acid, ammonia and potash	0
In ammonia and potash	27
In ammonia	87
In potash	62
Total	201

The extent to which they fall below guarantee is shown in the following table:

	BELOW GUARANTEE PER CENT.				
	.0-.10	.10-.25	.25-.50	.50-1.00	1.00 & over
In available phos. acid..	6	1	10	6	2
In ammonia	37	41	29	8	0
In potash	15	24	27	21	4
Total,	58	66	66	35	6

The number of samples deficient under the law is greater this season than last. Thirty out of 655 opposite seventeen (representing thirteen brands) out of 522 in 1905, or 4.58 per cent. opposite 3.26 per cent.

The relative number of samples falling below guarantee in one or more constituents, though not deficient in accordance with law, is a little less than last season, there being 201 out of 655, opposite 165 out of 522, or 30.68 per cent. opposite 31.61 per cent.

AVERAGES OF ANALYSES.

	1905. Per Cent.		1906. Per Cent.	
	Found	Gua'rt'd	Found	Guar't'd
ACID PHOSPHATES—				
Soluble phosphoric acid	11.49	.....	11.71	.....
Reverted phosphoric acid	3.32	.....	3.24	.....
Available phosphoric acid	14.81	13.99	14.95	14.03
Insoluble phosphoric acid	.76	.....	.60	.....
Total phosphoric acid	15.57	.....	15.55	.....
ACID PHOSPHATES WITH POTASH—				
Soluble phosphoric acid	7.65	.....	7.80	.....
Reverted phosphoric acid	3.05	.....	3.17	.....
Available phosphoric acid	10.70	9.98	10.97	9.97
Insoluble phosphoric acid	.66	.....	.63	.....
Total phosphoric acid	11.36	.....	11.60	.....
Potash soluble in water	3.07	3.03	3.30	3.15
COMPLETE FERTILIZERS—				
Soluble phosphoric acid	6.45	.....	6.54	.....
Reverted phosphoric acid	2.74	.....	2.80	.....
Available phosphoric acid	9.19	8.21	9.34	8.21
Insoluble phosphoric acid	1.48	.....	1.39	.....
Total phosphoric acid	10.67	.....	10.73	.....
Ammonia	3.12	3.05	3.26	3.23
Potash soluble in water	2.90	2.71	2.98	2.74
COTTON SEED MEALS—				
Available phosphoric acid	2.41	1.52	2.42	1.47
Ammonia	7.42	6.91	7.51	7.11
Potash soluble in water	1.54	1.01	1.57	1.00
KAINIT—				
Potash soluble in water	12.54	12.00	12.83	12.00
MURIATE OF POTASH—				
Potash soluble in water	50.49	49.33	50.05	48.50
SULPHATE OF POTASH—				
Potash soluble in water	.....	.....	49.57	48.00
NITRATE OF SODA—				
Ammonia (equivalent)	18.73	16.86	18.67	18.21

There were 8 samples of Sea Island meal this year. They are not included in the foregoing table. They averaged 4.71 per cent. of ammonia found, 4.81 per cent. guaranteed.

The following table shows the yearly averages of fertilizer analyses from the time the Board of Trustees of this college took charge of the station work down to the present time:

YEARLY AVERAGES OF ANALYSES FROM 1891 TO 1906, INCLUSIVE

SEASON	Acid Phosphates		Acid Phosphates with Potash			Complete Fertilizers				Cotton Seed Meals				Kainits		Muriate of Potash		Nitrate of Soda	
	Number of Samples	Available Phosphoric Acid Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Potash Soluble in Water Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Ammonia Per Cent.	Potash Soluble in Water Per Cent.	Number of Samples	Available Phosphoric Acid Per Cent.	Ammonia Per Cent.	Potash Soluble in Water Per Cent.	Number of Samples	Potash Per Cent.	Number of Samples	Potash Per Cent.	Number of Samples	Ammonia Per Cent.
1890-1	49	13.02	19	11.84	1.65	173	9.34	2.68	1.96	30	.....	8.37	.....	21	12.75	1	51.96	1	19.22
1891-2	29	12.92	16	11.50	1.49	112	8.83	2.80	1.95	25	.....	8.21	.....	18	12.51	....	.....	1	18.63
1892-3	48	12.32	26	11.63	1.22	150	9.00	2.91	1.65	20	2.62	8.40	1.32	20	12.05	....	.....	....	.....
1893-4	46	13.24	22	12.01	1.51	132	9.27	2.53	1.79	22	2.45	8.64	1.69	17	12.37	....	.....	....	.....
1894-5	46	13.55	15	12.09	1.66	87	9.42	2.55	1.77	33	2.58	8.19	1.66	19	12.30	....	.....	....	.....
1895-6	42	13.43	26	11.99	1.39	115	9.31	2.64	1.86	34	2.57	8.45	1.61	16	12.45	....	.....	....	.....
1896-7	59	13.61	34	12.06	1.61	117	9.55	2.70	1.91	40	2.53	8.69	1.64	22	12.44	....	.....	....	.....
1897-8	63	13.67	50	11.54	2.06	141	9.15	2.70	1.93	39	2.37	8.39	1.58	20	12.68	....	.....	1	19.23
1898-9	73	13.74	68	11.77	1.99	134	9.32	2.73	2.21	40	2.76	8.25	1.75	14	12.78	2	51.93	2	18.96
1899-1900	73	13.58	63	11.58	2.00	124	9.50	2.73	2.13	52	2.27	8.73	1.63	8	12.73	4	50.95	3	19.01
1900-1	56	14.00	55	11.49	2.65	139	9.40	2.87	2.47	60	2.38	8.55	1.54	12	12.61	2	48.92	3	18.96
1901-2	45	14.11	51	11.09	2.55	141	9.39	2.84	2.34	49	2.57	7.93	1.63	16	12.85	4	50.54	3	19.03
1902-3	51	13.74	55	10.94	2.65	139	9.02	2.69	2.42	69	2.27	8.08	1.48	15	12.92	2	50.25	2	19.15
1903-4	59	14.32	75	11.12	2.81	180	9.12	2.99	2.90	57	2.28	7.92	1.54	11	12.94	7	49.79	6	18.87
1904-5	81	14.81	82	10.70	3.07	250	9.19	3.12	2.90	62	2.41	7.42	1.54	26	12.54	6	50.49	7	18.73
1905-6	87	14.95	94	10.97	3.30	375	9.34	3.26	2.98	71	2.42	7.51	1.57	29	12.83	13	50.05	19	18.67

In this table, as in the foregoing ones, the ammonia yielded by the nitrogen in fertilizers is given instead of the nitrogen itself, as in the trade, goods are still bought and sold on the ammonia basis. The per cent. of nitrogen is readily calculated, as fourteen-seventeenths of the weight of the ammonia is practically the weight of the nitrogen it contains.

It will be observed that the average percentage of the fertilizing ingredients in acid phosphates and mixed fertilizers are higher this year than last.

The increase in the production of higher grade goods in recent years was referred to in the Annual Reports for 1904 and 1905. It is gratifying to see that the progress in this direction still continues, for it is, as stated in the Annual Report for 1904, doubtless due to the demands of farmers, who realize that it is poor economy to purchase low-grade fertilizers.

It is also gratifying to note that the average per cent. of ammonia yielded by the cottonseed meals is a little higher than it was last year.

GRADES.

In the following table the number of acid phosphates, acid phosphates with potash, and complete fertilizers of each grade, according to guarantee, is placed side by side with the number found by analysis to belong to that grade, fertilizers having commercial values equal to those of schedule grades being classed in those grades:

	HIGH		STANDARD		LOW	
	Cl'md	Fo'nd	Cl'md	Fo'nd	Cl'md	Fo'nd
Complete fertilizers (325) ..	173	201	140	115	12	9
Acid phos. with potash (94) ..	52	89	42	4	0	1
Acid phosphates (87)	83	84	4	3	0	0
Total (506)	308	374	186	122	12	10

These results are due to the following changes in grades, ascertained by analysis:

	Low to High	Low to Standard	Standard to High	High to Standard	High to Low	Standard to Low	No Change
Complete fertilizers (325)	0	9	31	3	0	6	276
Acid phosphates (87)	0	0	4	3	0	0	80
Acid phosphates with potash (94)..	0	0	37	0	0	1	56
Total (506)	0	9	72	6	0	7	412

This shows that out of 506 samples, 412 were of the grade claimed for them, 81 were of a higher grade and 13 of a lower grade than that claimed for them.

Last year out of 413 samples, 345 were of the grade claimed for them, 58 were of a higher grade and 10 of a lower grade than that claimed for them.

FARMERS' SAMPLES OF FERTILIZERS.

In addition to the samples of fertilizers collected by the Official Inspectors, there have been analyzed 48 samples for individual purchasers, as provided for in Section 1540 of the law respecting commercial fertilizers.

WATER.

There have been made this year 68 analyses of water from different parts of the State. Of these 47 were sanitary examinations, the rest complete or mineral water analyses.

CO-OPERATIVE WORK.

A considerable amount of work has been done by Messrs. McDonnell, Robertson and Henry in co-operation with the referee on nitrogen, and by Messrs. Robertson, Dickinson and Mitchell in co-operation with the referee on potash, for the Association of Official Agricultural Chemists.

DISTRIBUTION OF THE WORK.

Fertilizers were analyzed by Messrs. C. C. McDonnell, B. F. Robertson, W. E. Dickinson, and J. H. Mitchell; waters by Mr. D. H. Henry. Dr. R. N. Brackett has aided me in office duties and has attended, and made addresses at, a number of Farmers' Institutes.

Very respectfully,

M. B. HARDIN,
Chief Chemist.

REPORT OF THE HORTICULTURIST.

CLEMSON COLLEGE, S. C., November 13, 1906.

Prof. J. N. Harper, Director, Clemson College, S. C.

Dear Sir: I respectfully submit a report of the progress of experiments being conducted in the Horticultural Division of the South Carolina Experiment Station for the year 1905-'06.

The past season has been very unfavorable for the maturity of all truck crops and various kinds of fruits on account of the excessive rainfall during the months of June, July, August and September. During these four months, we had 38.61 inches of rain, which is only a few inches short of our average yearly rainfall. Our varieties of peaches, plums, apples and grapes were greatly damaged by this continuous rain, making it almost impossible for us to spray the fruit in order to prevent injurious effects from fungus diseases. Under the circumstances, however, we did manage to mature a large number of varieties of the above named fruits and were able to make the necessary notes on the same for future publications.

Apples.—Our old experiment apple orchard produced a rather heavy crop of fruit, all of the early apples maturing well, but the fall and winter apples were damaged greatly by fungus diseases, especially bitter rot and apple scab. Many specimens of these varieties were put up in jars for the purpose of exhibition. The young orchard of seedling apples that we planted four years ago is in splendid condition, and we expect to get a fair crop of fruit from it the coming season. These apples all originated in the Piedmont section of this State, North Carolina and Georgia, and promise to prove of great value to our locality. Our experiments have shown that the Northern winter apples do not thrive well in this latitude, and in order to secure varieties that will prove valuable for commercial purposes, we will have to select varieties originating in the South, and therefore well adapted to our climate. Experiments have been conducted with the various methods of grafting the apple. We have used various lengths of scions, from two inches up to eighteen inches in length, and used stocks varying from three inches to twelve inches in length. After a careful examination of these trees, after two years' growth, we are unable to note any great difference either in the formation of roots or in the

general growth of the trees. It is generally supposed that the long scions are better than short ones, but our experiments do not confirm this opinion.

Peaches.—Our young peach orchard produced only a small amount of fruit the past season. The majority of the fruit was killed by heavy frosts the last of March. The Carmen, Elberta, Pallas and General Jackson were the only varieties that produced a fair crop of fruit. These varieties in some way escaped the frost. On account of the excessive rainfall, however, they suffered greatly from brown rot.

Plums.—Out of forty-five varieties of plums in bearing, all of the fruit on these trees were killed during the last of March by heavy frosts. Only four or five varieties produced a fair crop, but about half of this was destroyed by brown rot, the weather conditions being such we could not spray the fruit.

Cherries.—We were able to secure notes on ten varieties of cherries. These all matured perfectly and were all very fine quality and attractive in appearance. These trees are growing on a very stiff, clayey soil and have borne heavy crops for the past three years. We have a few cherries growing on sandy soil, but these have proved to be of no value. The cherry delights in stiff, clayey soil.

Pears.—Our young variety orchard of pears that was set out two years ago is well under way and during the next season should produce a few fruits.

Pecans.—We have sixty-five seedling pecans bearing fruit this season. Some of them have produced nuts of good quality and large size, but the majority of them have produced nuts so small that they would be worth very little on the market. These trees were all produced from nuts of large size and good quality. The best nuts *secured* will require about sixty-five to make a pound, while the smaller nuts will require from one hundred and seventy-five to one hundred and ninety-two to the pound. This shows plainly the advantage of either budding or grafting the trees in order that we may secure uniform nuts. These trees are now twelve years old and most of them have been in bearing for three years.

Raspberries and Blackberries.—For the past five years we have been growing a number of varieties of raspberries and

blackberries. These have borne a heavy crop every year. The best varieties of raspberries for our section are the following: The Turner, The Cuthbert, The Gregg and Shaffer's Colossal. The following varieties of blackberries have given best results: Early Harvest, Wilson's Early and Agawam.

Strawberries.—We have now growing in the horticultural grounds one hundred and fifty varieties of strawberries. We have made careful notes on these varieties from year to year and recommend the following as being best suited for our section of the State: Early, Excelsior; Medium, Lady Thompson; Late, Haverland. These three varieties will cover the entire fruiting season of the strawberry. They will give a continuous lot of fruit from the time the berries first begin to ripen until all are gone. We are conducting experiments with the various methods of culture, such as mulching the plants compared with clean culture, also using the following systems under clean culture: Single crown system, single hedge system, double hedge system and narrow matted rows. Our results of the past season show that the single crown and single hedge systems are superior to the others. These two systems produce an abundance of large berries. While the others produce more berries, they are smaller and it is more difficult to cultivate the plants.

Grapes.—Our variety vineyard this season gave very good results considering the season. We brought to maturity eighty-five varieties. It was necessary, however, to spray these continually in order to check the fungus disease. We have continued the experiment with various methods of pruning. The Four-arm Spur system and Four-arm Cane Renewal have given the best results.

Rotunda Folia Grapes.—We have been growing the Rotunda Folia type of grapes on trellises for the past ten years, and while this method is not usually practiced, we believe it to be far superior to the common arbor system. We have kept these vines pruned severely every year and, by actual weight, they have produced on an average of five bushels to the vine. The following varieties are to be recommended: Thomas, James and Flowers. The Thomas and James are both early varieties, but the Flowers comes in from two to three weeks later and remain

on the vine in good condition until the last of October. The scuppernong, which is grown very generally over the State, is one of the very best grapes of its type and is recognized as a favorite. The black varieties, however, are not as well known and as highly appreciated as they merit.

Hybrid Oranges.—Several years ago we received a number of hybrid oranges from the U. S. Department of Agriculture. These were planted in the horticultural grounds for trial. These trees are growing vigorously and as yet have not been injured by the severe winters, and from present prospects these varieties will fruit well in our State without danger of being injured by cold.

Musk Melons (Cantaloupes).—For the past three years we have been conducting variety experiments with cantaloupes, but every year they have been very much damaged by blight and it was necessary to spray continuously in order to check this disease. Four years ago we noticed a few vines that seemed comparatively free from this disease. We have been breeding from these comparatively immune vines, and we hope in the course of a few years to produce a first-class variety that we can grow without the necessity of spraying to check this disease. We are now growing these melons under glass and hope to gain one season in that way. The seed saved last summer were planted under glass in October. We hope to fruit these during the coming winter and save seed for planting next spring.

Celery.—For the past four years we have been conducting experiments with the methods of bleaching celery, also with the various methods of keeping celery during the winter. Our variety test shows the following varieties to be among the best: Giant Pascal, Shumatcher and Fin de Siecle. The results of our experiments will be ready for publishing in the course of a few weeks.

Onions.—The following experiments have been conducted with onions: Variety tests, methods of culture, with special reference to the distance of planting, time of planting, and the comparison of onions grown from sets with those grown from seed. Our best results have been obtained from seed sown during the middle of October. These plants were allowed to

remain in the open ground during the winter and matured during the following June. These onions were at least twice as large as those from seed sown in March. They also produced much larger onions than sets planted in March. In reference to the keeping quality, we found that the onions grown from seed would keep readily during the winter, while those grown from sets are very difficult to keep longer than the last of October.

Lettuce.—Our experiments with lettuce have been confined to variety tests and growing it under glass for winter use. We are now growing lettuce in cold frames and in the greenhouse, using bottom heat to force the plants to maturity. Lettuce will grow well out-of-doors in this section, with very slight protection, until the middle of December. After that time it should be protected with canvas or glass.

Cauliflower and Cabbage.—During the past three years we have conducted variety experiments with cabbage and cauliflower. Only a few of the varieties of cauliflower, however, have proved to be of much value. The Early Snowball is decidedly the best variety we have grown. The following varieties of cabbage are recommended: Charleston Wakefield for early, followed by Succession and All Seasons. These varieties are best for spring use. They also do well planted in summer, maturing during the months of October and November.

Eggplant.—This is one of our most difficult vegetables to grow on account of its being attacked in its early stage by fungus diseases and insects. By proper treatment, however, we can bring these plants to maturity. We have conducted experiments for the past three years with eggplants and our results are now ready for publication. The New York Purple and Black Beauty are decidedly the best varieties we have grown.

Tomatoes.—The following experiments have been conducted: Variety tests, methods of culture, pruning and training to stakes. We are also growing tomatoes in the greenhouse and have secured very good results. Our second crop of tomatoes under glass is now well under way, the plants blooming freely.

Irish Potatoes.—The following experiments have been conducted with Irish potatoes: Variety tests, different depths of planting, varying from three to twelve inches; methods of culture, including comparison of fall, winter and spring planting; methods of keeping potatoes during the winter. The past few years experiments with Irish potatoes show that the fall crop always keep much better than the first crop. Under ordinary conditions, the fall crop may be kept during the entire season, while the early crop decays badly during the summer months.

Respectfully yours. C. C. NEWMAN,
Horticulturist.

REPORT OF THE ENTOMOLOGIST.

CLEMSON COLLEGE, S. C., November 20, 1906.

Prof. J. N. Harper, Director, South Carolina Experiment Station.

Dear Sir: Although my study of the insects affecting the rice plant has not been completed, I am preparing a report on what has been done. This publication will contain information that not only relates to the commoner insect pests of the crop, but to many species hitherto not listed as injurious insects of the rice plant. On account of other duties, I have never reached the rice fields in time to study the insects affecting the crop during dry growth, and without observations during this period, the investigation cannot be finished. The problem of determining whether insects bear any relation to the distribution of "blast" or "rotten-neck" has been discontinued because of the resignation of the botanist with whom the work was originally planned. A continuance of this phase of the work is desirable and very important.

The progress of the investigation on the life history of the "stomach worm" (Strongylus contortus Rud) is gratifying in the main, though repeatedly interrupted by the presence of the parasite within the available animals for experimental purposes. These delays, however, have not been without value. Within another season, through continued co-operation with the Veterinary Division, I firmly believe that methods for freeing pastures and raising animals free of the parasite will be secured.

Beside the problems already mentioned, I have given considerable time to the collection of biological data on the insects that have been unusually common on the cotton and corn crops of the State.

In my correspondence, I have answered numerous questions relative to the habits and control of insects affecting fruits, vegetables, household goods and domestic animals. While I have stressed the importance of preventive measures, I have also pointed out the necessity of owning and using a spraying outfit, if losses from insects are to be minimized or prevented. If I am to judge of the value of these recommendations from the results that have been obtained, it is a most encouraging sign of the appreciation of economic entomology on the part of our constituency.

In conclusion, I may add that the work of this division has been greatly facilitated by the completion of the greenhouse, the north wing of which has been equipped for an insectary.

Yours respectfully, CHAS. E. CHAMBLISS,
Entomologist.

REPORT OF THE VETERINARIAN.

CLEMSON COLLEGE, S. C., November 20, 1906.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I have the honor to submit the following report of the work of the Division of Veterinary Science for the year ending June 30th, 1906:

The experiments in the treatment of "scours" in milk-fed calves were brought to a successful conclusion. A method of treatment was developed which is very efficacious, simple and easily applied, and which it is believed will prove of great practical value. A full report of this work was published in Bulletin No. 122.

The study of the disease caused by the stomach worm (strongylus contortus) in young cattle and sheep has been continued in co-operation with the Division of Entomology and Zoology. Certain obstacles have been met with that have delayed the work somewhat, chief among which is the difficulty in securing suitable experimental animals free from the para-

site; but, nevertheless, considerable progress has been made and we have every reason to believe that we will eventually be able to furnish information of some value. This parasite is more widespread than is generally realized and any knowledge that will assist in its control will be of great economical importance.

A series of experiments testing several methods of eradicating cattle ticks have been conducted on several farms in this County, in co-operation with the U. S. Department of Agriculture. This work was considerably disarranged by a delay in the transportation of some of the material, and was also further interfered with by the failure of some of the owners of the farms to observe the plans. In some respects, however, the results have been satisfactory and the work will be continued.

Very respectfully, LOUIS A. KLEIN,
Veterinarian.

REPORT OF THE DAIRY AND ANIMAL HUSBANDMAN.

CLEMSON COLLEGE, S. C., November 5, 1906.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I respectfully submit herewith a report of the work of the Division of Animal Husbandry and Dairying for the year ending June 30, 1906:

A thorough study has been made of the relative feeding value of wheat bran and cotton seed meal for milk production. The results of this study were published in Bulletin No. 117.

An investigation was also made of the markets for average dairy butter, which resulted in the publication of Bulletin No. 118, entitled, "Gathered Cream Plants." One or more of these plants is strongly recommended for this State.

The evident value of dairy farming to South Carolina has lead to the publication of a bulletin on this subject.

Another bulletin, covering an investigation of the water content and keeping quality of butter, is now ready to go to press.

A year ago this division undertook to determine the profitableness of swine raising in this State. Accordingly six grade brood sows and one pure bred Berkshire boar were procured

to serve as foundation stock. This foundation stock has yielded fifty-eight strong, vigorous offsprings, nearly every sow producing two litters of pigs during the year. The shotes from the first litter now average 160 lbs. per head. The feed consisted almost entirely of skim-milk (for young pigs), Dwarf Essex rape pasture, Bermuda grass pasture, sorghum and artichokes. The results have been highly satisfactory and will be published in bulletin form during the coming year.

A new line of work has been taken up by the division, namely, the breeding of horses. A pair each of pure bred German Coach and Standard bred mares has been purchased. This purchase and that of nine pure bred Jersey cows, together with the erection of a large piggery, have materially strengthened this division.

Respectfully submitted, JOHN MICHELS,
Dairy and Animal Husbandman.

REPORT OF THE ASSOCIATE AGRICULTURIST.

CLEMSON COLLEGE, S. C., November 20, 1906.

Prof. J. N. Harper, Director, S. C. Experiment Station, Clemson College, S. C.

Dear Sir: I respectfully submit the following report of the Agricultural Division of the Experiment Station:

The work of this division has been continued upon the lines reported November 28, 1905, and the scope extended and enlarged in an endeavor to secure such information for the farmers as they appear to be in need of.

This division had on exhibition in the institute car the following products grown on the experiment station grounds: Sixty varieties of cotton; twenty-four of wheat; forty-five of cowpeas; corn, oats, alfalfa, clover, vetch, etc. At the State Fair, the division exhibited the following: Sixty varieties of cotton; twenty-five of wheat; twenty of corn; forty-five varieties of cowpeas; eleven of sorghum; upland rice, chufas, Soy beans, alfalfa, crimson clover and Hairy vetch.

A large number of small packages of seed of cotton, corn and cowpeas have been distributed to farmers throughout the State, that the varieties succeeding best on the station grounds might

be tested in other localities. There have been more calls for such seed than the division was able to supply.

A number of crops have been grown experimentally, the most noteworthy being:

Cotton.—About eighty varieties for comparison to serve as a basis from which to select the better varieties for future work. The work of improvement in breeding cotton was continued and is to be enlarged as means and opportunity are afforded. A sufficient quantity of lint from one of the cross-bred varieties was submitted to the Textile Department that a mill test might be made. The very favorable results secured from this test emphasized the importance of further work to be done in co-operation between the Textile Department and Experiment Station. Since the Southern mills are producing a higher grade of cloth, and the demand for staple of special character is increasing, the work begun in this line indicates an opportunity for experimental work of peculiar interest and value.

Corn.—For several years a comprehensive series of tests have been conducted in co-operation with the U. S. Department of Agriculture. The main object of these tests is to determine the best variety of corn for this section and the best locality from which to procure seed. A bulletin setting forth the results as attained will be published as soon as the opportunity is afforded. The work of breeding a promising variety of corn by selection and cross pollination is under way and results attained so far are very promising. The results attained from careful selection and breeding of animals have been exceedingly profitable for many years, and as the facts controlling the proper selection and breeding of plants becomes better understood, these results will be of proportionally equal importance.

Wheat.—The results attained in the work with wheat for the past several years leads to the conclusion that the State should produce its own flour. By the use of good seed of suited varieties, fifteen to twenty bushels per acre have been secured, and by following the wheat with cowpeas from one to three tons of hay have been harvested. At prevailing prices there is more profit from an acre producing fifteen bushels of wheat and one and a half tons of cowpea hay than from an acre

producing a bale of cotton; and, further, the wheat and cowpeas leave the land in a better condition for the production of future crops.

Oats.—By practicing the open furrow system of planting the oat crop has become a comparatively safe one and may be grown more generally throughout the State than wheat, and probably with more profit to the farmers.

Cowpeas.—Work with this important hay and soil improvement plant has been continued with reference to the comparison of varieties for the several purposes for which the cowpea is grown, with reference to improvement of strains, to the feeding and fertilizing value and to curing the hay.

Sorghums.—A variety of sorghums, clovers and grasses have been under test. Efforts are being made to grow alfalfa on the ordinary uplands of the Piedmont section of the State. *Peanuts* and *chufas* have been found to produce abundantly, and with only ordinary cultivation and fertilization. These two crops, with several others admirably suited to hog raising, are highly recommended as hog foods to be gathered by the hogs themselves. Results obtained from *upland rice* this year indicate that it may be grown profitably both for grain and for hay or forage. A long list of varieties of imported *vetch* seed has been supplied the station by the Department of Agriculture and is under test. Many of these are imported from various foreign countries.

Respectfully submitted, C. L. NEWMAN.

REPORT OF THE BOTANIST AND BACTERIOLOGIST.

CLEMSON COLLEGE, S. C., November 17, 1906.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: I herewith submit the report of the Division of Botany and Bacteriology for the year ending July 1st, 1906:

Correspondence.—This division has conducted a large amount of correspondence during the past year upon various topics, including cotton diseases; identification of grasses, weeds and other plants; fruit tree and plant diseases; sanitary conditions; graded school and nature study work. The sub-

jects of the correspondence as given above are in order of the number of letters received and answered.

Books.—Several new and valuable books have become available for use by the division during the last year. Among them are included new volumes of Engler & Prantl, The National Standard Dispensary and Schimper's Plant Geography, which are particularly valuable. Books relating to systematic botany are much needed by the division. Their purchase would avoid the reference of much correspondence and numerous specimens, especially grasses, to the U. S. Department of Agriculture for authentic determination.

Herbarium.—The herbarium has been entirely overhauled and rearranged between January the first and July the first. About five hundred specimens, representing the flora of the State and the eastern United States, were added during that period. The private herbarium of the botanist of over fifteen hundred mounted specimens has been placed on deposit in the herbarium. The herbarium in general was found to be in a very poor condition. Much of the work of previous botanists has been more or less wasted by the destructive work of insects, and every effort is being made to secure insect proof cases. A large number of botanical specimens representing the flora of South Carolina are ready for mounting as soon as cadet labor is available for that purpose. The collection of South Carolina grasses and other plants representing groups of more or less economic interest have been given particular care. The herbarium has been divided into three parts, one part representing the native flora of South Carolina; another part representing a general collection of the United States outside of South Carolina. In the third part, a record of all cultivated economic and ornamental plants is being made by means of well preserved specimens.

Investigation.—The investigations of this division under Prof. Metcalf culminated with the publication of his preliminary report on the rice blast, which appeared as a recent bulletin of the station. The work of the division under the present botanist, who has occupied the position only since January first, has been largely reorganization and observations in various parts of the State to determine what lines of work of the many

available, seem to be the most urgent. The result has been the mapping out of the following course of investigation: A study of the diseases of cotton, with particular reference to the influences of soil conditions upon their occurrence, and the relation of certain insects to subsequent diseased conditions. This will necessitate co-operation with the entomologist and possibly the agriculturist. Active investigation along this line will be begun early next season. Other points of interest along which more or less investigation is being carried on are upon the following subjects: The flora of the State, forest conditions and commercial and agricultural values of wild plants and fruits.

Respectfully,

H. D. HOUSE,
Botanist and Bacteriologist.

REPORT OF THE SECRETARY AND LIBRARIAN.

CLEMSON COLLEGE, S. C., November 23, 1906.

Prof. J. N. Harper, Director, S. C. Experiment Station.

Dear Sir: Responding to your request, I beg to submit the following report of some of the work as Secretary and Librarian of the Experiment Station for the period of the fiscal year, beginning July the 1st, 1905, and ending June 30th, 1906:

The agricultural public of South Carolina still continues to manifest an increasing interest in the publications of this Experiment Station. This has been clearly demonstrated by the fact that during the year just closed, 1,817 representative farmers applied to have their names enrolled on the permanent mailing list kept by this office for the distribution of bulletins.

The station has issued during the year nine bulletins, and one annual report. These contain in the aggregate 247 pages. Besides the analyses of commercial fertilizers, these bulletins represent intelligent discussions on quite a variety of subjects, such as: "Methods of Spraying Cucumbers and Melons," "A Comparison of Wheat Bran and Cotton Seed Meal for Milk Production," "Gathered Cream Plants," "Cotton Experiments," "Report on Rice Blast," "Calf Scours," and "Forage Crops."

The work of distributing the analyses of commercial fertilizers among the farmers of the State was begun in the month

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of January. A leaflet of four pages, containing the analyses, was published at the college and mailed from this office once a week for twenty weeks, in editions of 12,000 copies each. These leaflets visited with weekly regularity 12,000 farms in this State, and the purpose of their publication was the protection of the farmers against the purchase of fraudulent fertilizers, by providing them with the records of the chemical analyses before the purchases were made.

The total number of bulletins issued from this station during the past fiscal year, including the fertilizer leaflets, amounted to 336,000 copies.

A complete file of all the bulletins from the various experiment stations in the United States, and some foreign States, is carefully kept, with a record of their subjects and numbers on the bulletin catalogue. These are subsequently put into convenient forms and bound into volumes.

It requires the exercise of constant and patient vigilance to keep the station mailing list free from errors. With this end in view, a careful examination of the list is rendered necessary after the distribution of each edition of the regular bulletins.

All of which is respectfully submitted,

JNO. N. HOOK,
Secretary and Librarian.